REMARKS

Claims 1-11 are pending in this application.

Rejection of Claims 1, 9 and 11 under 35 USC § 102(e)

Claims 1, 9 and 11 are rejected under 35 U.S.C. 102(e) as being anticipated by Davison et al.

The present claimed invention provides a method for constructing a 3D scene model by analyzing image sequences. Each image corresponds to a viewpoint defined by its position and its orientation. A depth map corresponding to the depth in 3D space of the pixels of the image is calculated. A resolution map corresponding to the 3D resolution of the pixels of the image from the depth map is then calculated. A pixel of a current image is then matched with a pixel of another image of the sequence. Pixels relating to one and the same point of the 3D scene are determined by projecting the pixel of the current image onto the other image. A pixel of the current image is selected depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel. A 3D model is then constructed from the selected pixels. The invention relates to a process for constructing a 3D scene model by analyzing image sequence. The present invention aims to create a process allowing for improvement in the possibilities of navigation in the virtual scene.

Davison et al. neither disclose nor suggest "calculation, for an image, of a resolution map corresponding to the 3D resolution of the pixels of the image, from the depth map" as in the present claimed invention. Davidson et al. also neither disclose nor suggest "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. Additionally, Davison et al. neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of

the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention.

Davison et al. describe an apparatus and method for creating three-dimensional models of an object. The images of the object are taken from different unknown positions and are processed to identify the points in the images which correspond to the same point on the actual object. The matching points are used to determine the relative positions from which the images are taken, and the matching points and calculated positions are used to calculate points in a 3D space representing points on the object.

The Office Action contends that Davison et al., broadly interpreted, anticipates the limitations of claim 1. In the Office Action it is asserted that in steps S558-S560 in Figure 44a of Davison et al., the discarding points of excessive inter-point distance results in the selection of a set of points, and correspondingly a set of pixels used in the subsequent construction shows the step of selecting a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel of the present claimed invention. Applicants respectfully disagree. Step S558 of Davison et al. determine whether the magnitude of the shift calculated at step S554 is greater than 10% of the object size calculated at step S552. If the shift is greater than 10%, the point under consideration for the current pair of camera positions and the corresponding point for the subsequent pair of camera positions are considered to be inaccurate and discarded at S560, as described in column 44, lines 6-24. Consequently, the shift or inter-point distance represents an error. Although the shift corresponds to different pixels in the 2D representation, they all relate to only a 3D point. The shift thus does not represent a distance between two 3D points, but simply a single point in space. As this shift provides only 2D accuracy and relates only to a 3D point, it can not be the distance between two different 3D points and consequently can not be considered as a 3D resolution. Thus, Davidson et al. neither discloses nor suggests "calculation, for an image, of a resolution map corresponding to the 3D resolution of the pixels of the image, from the depth map" as in the present claimed invention.

In the present claimed invention, the 3D resolution is defined throughout the specification, and more specifically on page 5, lines 14-21. For each of the pixels belonging to a window, the depth information is processed so as to determine, from the distribution in 3D space of the points around the processed pixel, the 3D resolution. For a current pixel, its 3D resolution depends on the depth of neighboring 2D pixels. After processing all the pixels of the image, a resolution map of the image is obtained for each of the images of the sequence and the range of the depth values of these pixels determines the resolution.

Furthermore, in the present claimed invention, an image corresponds to a viewpoint defined by its position and its orientation. Starting from a pixel of the image i, it is possible to determine its projection point in an image j via known geometrical transformation, as described on page 8, lines 20-21. Davison et al., neither disclose nor suggest "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. Davison et al. additionally neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention. In fact, unlike the present claimed invention, Davison et al. are concerned with matching pixels of images to calculate error rotation matrices and error translation vectors. Davison et al. are not concerned with use of the 3D model and matching images to identify redundancy as in the present claimed invention. In the present claimed invention, only useful data is stored as described on page 3, lines 4-10. Furthermore, inter-point distance, as described in Davison et al., can neither be assimilated to nor suggest 3D resolution. Inter-point distance only provides accuracy in 2D. Consequently, Davison et al., even when broadly interpreted, does not anticipate claim 1 of the present invention.

In view of the above remarks it is respectfully submitted that there is no 35 USC 112 compliant enabling disclosure in Davison et al. showing the above discussed features. As claims 9 and 11 are dependant on claim 1 it is respectfully submitted that these claims are allowable for the same reasons as discussed above. It is thus further respectfully submitted that claims 1, 9 and 11 are not anticipated by Davison et al. It is thus, further respectfully submitted that this rejection is satisfied and should be withdrawn.

Rejection of Claim 2 under 35 USC § 103(a)

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davison et al., in view of Azarbayejani et al. (U.S. Patent 5,511,153).

Similarly to Davison et al., Azarbayejani et al. neither disclose nor suggest "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. Azarbayejani et al., also similarly to Davison et al., neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention. Azarbayejani et al. describe a method and apparatus for generating a three-dimensional, textured computer model from a series of video images. The invention operates by tracking a selected group of object features through a series of image frames, and based on their relative positions, estimates parameters specifying camera focal length, translation and rotation, and the positions of the tracked features in the camera reference frame.

Even if Azarbayejani et al. were combined with Davidson et al., the combined system would not produce the present claimed invention. This combination would produce an image processing apparatus for creating a 3D textured computer model form a series of video games. This combination neither discloses nor suggests "matching of a pixel of a current image with a pixel of another image of the sequence,

pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. The combined system also neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention.

In view of the above remarks it is respectfully submitted that there is no 35 USC 112 compliant enabling disclosure in Davison et al. in view of Azarbayejani et al. showing the above discussed features. It is thus further respectfully submitted that claim 1 and dependent claim 2 are patentable over the combination of Davison et al. and Azarbayejani et al. It is thus, further respectfully submitted that this rejection is satisfied and should be withdrawn.

Rejection of Claims 4 and 5 under 35 USC § 103(a)

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davison et al., in view of McAllister et al. (Real-Time rendering techniques of real world environments).

Similarly to Davison et al., McAllister et al. neither disclose nor suggest "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. McAllister et al., with Davison et al., also neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention. McAllister et al. recite an end-to-end system for acquiring highly detailed scans of large real world spaces, consisting of forty to eighty million range and color samples, using a digital camera and laser rangefinder.

Additionally, a combination of McAllister et al. with Davison et al. would not produce the present claimed invention. This combination would produce an end-to-end system for acquiring highly detailed scans of large real world spaces using a digital camera and laser rangefinder for processing 3D models of objects. This combination neither discloses nor suggests "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. The combined system also neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention.

In view of the above remarks it is respectfully submitted that there is no 35 USC 112 compliant enabling disclosure in Davison et al. in view of McAllister showing the above discussed features. It is thus further respectfully submitted that claim 1 and dependant claims 4 and 5 are patentable over the combination of Davison et al. and McAllister. It is thus, further respectfully submitted that this rejection is satisfied and should be withdrawn.

Rejection of Claim 10 under 35 USC § 103(a)

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davison et al., in view of La Roux et al. (An Overview of Moving Object Segmentation in Video Images, IEEE, 1991).

Similarly to Davison et al., La Roux et al. neither disclose nor suggest "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. La Roux et al., also similarly to Davison et al., neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in

claim 1 of the present claimed invention. La Roux et al. disclose a method for modelling a 3D object from an image sequence. 3D objects are modelled by combining state-of-the-art algorithms for un-calibrated projective reconstruction, self calibration and dense correspondence matching.

Even if La Roux et al. were combined with Davison et al., the combined system would not produce the present claimed invention. This combination would produce an apparatus for processing 3D models of objects from an image sequence. This combination neither discloses nor suggests "matching of a pixel of a current image with a pixel of another image of the sequence, pixels relating to one and the same point of the 3D scene, by projecting the pixel of the current image onto the other image", as claimed in claim 1 of the present claimed invention. The combined system also neither disclose nor suggest "selection of a pixel of the current image depending on its resolution and on that of the pixels of other images of the sequence matched with this pixel", as claimed in claim 1 of the present claimed invention.

In view of the above remarks it is respectfully submitted that there is no 35 USC 112 compliant enabling disclosure in Davison et al. in view of La Roux showing the above discussed features. It is thus further respectfully submitted that claim 1 and dependant claim 10 are patentable over the combination of Davison et al. and La Roux et al. It is thus, further respectfully submitted that this rejection is satisfied and should be withdrawn.

Having fully addressed the Examiner's rejections, it is believed that, in view of the preceding amendments and remarks, this application stands in condition for allowance. Accordingly then, reconsideration and allowance are respectfully solicited.

In view of the above remarks and amendments to the claims, it is respectfully submitted that this rejection is satisfied and should be withdrawn.

If, however, the Examiner is of the opinion that such action cannot be taken, the Examiner is invited to contact the applicant's attorney at the phone number below,

so that a mutually convenient date and time for a telephonic interview may be scheduled.

No fee is believed due. However, if a fee is due, please charge the additional fee to Deposit Account 07-0832.

Respectfully submitted,
Yannick Nicolas et al.

By: _____
Jack Schwartz
Reg. No. 34,721
Tel. No. (609)734-6866

Thomson Licensing Inc.
Patent Operations
PO Box 5312
Princeton, NJ 08543-5312
August 9, 2005

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Date: August 9, 2005 Linda Lindall